CampbellReith
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Heath House
North End Way
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Basement Impact Assessment
Audit

For

London Borough of Camden

Project Number: 12336-18
Revision: F1

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1.0 NON-TECHNICAL SUMMARY

1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for Heath House, North End Way, London NW3 7ET (planning reference 2015/6280/P). The basement is considered to fall within Category B as defined by the Terms of Reference.

1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.

1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.

1.4. The BIA has been prepared by JNP Group Consulting Engineers and includes documents prepared by STATS Limited in 2008. Following the initial audit, additional ground investigations, ground movement assessment, and damage assessment were undertaken by Geotechnical & Environmental Associates (GEA) in July 2016. It has been confirmed that the individuals who prepared the documents possess suitable qualifications.

1.5. It has been confirmed that the development site involves a Grade 2 listed building.

1.6. The proposal includes the conversion of the Heath House from single family dwelling to six self-contained residential apartments, a double storey extension to the west, extension of the existing garage to the south and a single level basement below the existing lower ground of the existing building. The proposal utilises an implemented planning consent granted in 2008. The principal change includes the larger garage to the south.

1.7. It is noted that the Planning Statement by Indigo states a single storey west extension while the architectural drawings show double storey extension.

1.8. The BIA has stated that the proposed basement will be founded in the medium dense to dense sand and gravels of the Bagshot Formation.

1.9. The ground investigation and subsequent water monitoring by STATS in 2008 indicates the groundwater level to be in excess of 18m below existing ground level. Following the initial audit, additional ground investigation and water monitoring have been undertaken by GEA. The additional information indicates that groundwater level is likely to be much lower than the proposed basement level. Perched water may be present at +124.73 AOD, which is about 5m lower than the proposed basement level.

1.10. It is accepted that there are no hydrogeological or hydrological concerns with respect to the development proposals.

1.11. Following the initial audit, additional information has been provided by JNP Group. The basement walls below the existing Heath House will be formed by reinforced concrete underpinning. The basement walls to the west will be formed by contiguous piles with waterproof concrete lining walls. Outline calculations for the slabs, foundations, and retaining walls have been provided.

1.12. An outline construction sequence has been provided with indicative temporary works to support the retaining walls. It is noted that detailed construction methodology will be developed by the contractors at later stages.

1.13. Following the initial audit, Ground Movement Assessment and Damage Assessment have been carried out to assess the effect of the proposed development on the existing Grade II listed building and the boundary walls. The predicted damage category for the existing building is generally Negligible (Burland Category 0). All of the boundary walls are predicted to also have Negligible damage category, except one to the south, which is predicted to have Very Slight damage category (Burland Category 1). However, there are queries on the approach used in the Ground Movement Assessment which require to be resolved before this can be validated.

1.14. The BIA has stated that ground movement monitoring will be undertaken to monitor the existing building and adjoining boundary walls during the construction stages. An appropriate ground movement monitoring strategy has been provided.

1.15. It is noted that the revised structural drawings and the ground movement assessment (GMA) have included the car park extension at lower ground level, which has been omitted on the revised architectural drawings submitted in July. The structural design and the GMA should be updated to reflect the proposed plans as shown on the architectural drawings.

1.16. Queries and requests for clarification are described in Section 4 and summarised in Appendix 2.

2.0 INTRODUCTION

2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 28 January 2015 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for Heath House, North End Way, London NW3 7ET, Camden Reference 2015/6280/P.

2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.

2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within:

- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
- Camden Planning Guidance (CPG) 4: Basements and Lightwells.
- Camden Development Policy (DP) 27: Basements and Lightwells.
- Camden Development Policy (DP) 23: Water.

2.4. The BIA should demonstrate that schemes:

a) maintain the structural stability of the building and neighbouring properties;

b) avoid adversely affecting drainage and run off or causing other damage to the water environment; and,

c) avoid cumulative impacts upon structural stability or the water environment in the local area

and evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.

2.5. LBC's Audit Instruction described the planning proposal as *"Conversion of existing single dwelling house to 6 self-contained residential units; erection of new west side wing comprising basement, lower ground, ground and first floors; erection of rear conservatory extension; remodelling roofs of main house and east side wing; excavation of front forecourt to provide basement level carpark; various external alterations and associated landscaping."* The Audit Instruction also confirmed the property is a listed building.

2.6. CampbellReith accessed LBC's Planning Portal on 10 February 2016 and gained access to the following relevant documents for audit purposes:

- Basement Impact Assessment dated 02 November 2015 by JNP Group.
- Environmental Study dated October 2007 by STATS Limited (Included in Appendix 4 of the BIA).
- Geotechnical and Geoenvironmental Investigation dated July 2008 by STATS (included in Appendix 5 of the BIA).
- Architect's General Arrangement Plans and Cross-Sections Planning Issue dated October 2015, Existing and Proposed, by Charlton Brown Architects.
- Planning Statement dated November 2015 by Indigo.
- Construction Management Plan undated by Consero London.
- Flood Risk Assessment dated 7 August 2015 by Consero London.
- Indicative Underpinning and Contiguous Piling Details (Included in Appendix 6 of the BIA).
- Landscape Design Statement dated September 2015 by ACD Landscape Architects.

2.7. Subsequent to the issue of the initial audit report, further information was provided by the structural engineers as detailed below. This revised audit report considers that later information:

- Additional Ground Investigation and Ground Movement Assessment Report dated July 2016 by Geotechnical & Environmental Associates (GEA).
- Monitoring Specification dated July 2016 by Geotechnical & Environmental Associates (GEA).
- Supplementary Basement Impact Assessment dated July 2016 by JNP Group.
- Additional structural calculations for the underpins below Heath House's walls dated August 2016.
- Revised Drawing C85234-D-211 Revision C dated 08 August 2016.

3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	Yes	See BIA Executive Summary Section.
Is data required by Cl.233 of the GSD presented?	Yes	
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	Yes	See BIA and Planning Statement.
Are suitable plan/maps included?	Yes	
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	Yes	
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 3.2. In Q13, the justification does not consider the existing building on the site.
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 3.1.
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	Yes	BIA Section 3.3.
Is a conceptual model presented?	Yes	Geotechnical & Geoenvironmental Report.
Land Stability Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 4.2.

Item	Yes/No/NA	Comment
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 4.1.
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	Yes	BIA Section 4.3.
Is factual ground investigation data provided?	Yes	Geotechnical & Geoenvironmental Report Sections 3,4 and 5.
Is monitoring data presented?	Yes	Groundwater monitoring in the Geotechnical & Geoenvironmental Report Sections 4.2.
Is the ground investigation informed by a desk study?	Yes	Geotechnical & Geoenvironmental Report Section 2.2 and Environmental Study Report.
Has a site walkover been undertaken?	Yes	Environmental Study Report.
Is the presence/absence of adjacent or nearby basements confirmed?	Yes	BIA Section 3.2. The property is detached and quite distant from any other properties.
Is a geotechnical interpretation presented?	Yes	Geotechnical & Geoenvironmental Report.
Does the geotechnical interpretation include information on retaining wall design?	Yes	BIA Section 7.4.
Are reports on other investigations required by screening and scoping presented?	Yes	Ground Investigation report.
Are baseline conditions described, based on the GSD?	No	No reference to the GSD.
Do the base line conditions consider adjacent or nearby basements?	Yes	

Item	Yes/No/NA	Comment
Is an Impact Assessment provided?	Yes	BIA Section 6.
Are estimates of ground movement and structural impact presented?	Yes	
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	Yes	
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	Yes	
Has the need for monitoring during construction been considered?	Yes	
Have the residual (after mitigation) impacts been clearly identified?	No	
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	No	Structural stability of the existing building has not been not demonstrated there are queries on the approach used in the GMA (see Audit paragraphs 4.8 to 4.12).
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	Yes	
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	No	Structural stability of the existing building has not been not demonstrated. There are queries on the approach used in the GMA (see Audit paragraphs 4.8 to 4.12).
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	Yes	However, there are queries on the approach used in the GMA.
Are non-technical summaries provided?	Yes	BIA Section 5.2.

4.0 DISCUSSION

4.1. The Basement Impact Assessment (BIA) has been prepared by JNP Group Consulting Engineers and consists of the main assessment report, prepared in November 2015, the Environmental Study prepared by STATS Limited in 2007, and the Geotechnical and Geo-environmental Report which was also prepared by STATS Limited in July 2008. Following the initial audit, additional ground investigations, ground movement assessment, and damage assessment were undertaken by Geotechnical & Environmental Associates (GEA) in July 2016. The authors of the submitted documents have been confirmed to possess suitable engineering qualifications that meet LBC requirements.

4.2. The development site consists of a Grade II Listed building. The proposal includes a double storey extension to the west, extension of the existing garage to the south and a single level basement below the existing lower ground of the existing building. The current scheme is an amendment to a previously consented scheme in 2008. The comparison drawings prepared by Charlton Brown Architects show that the primary changes, which may affect land stability, hydrogeology, and hydrology, are the extension of the car park to the south of the existing building and the change to the layout of the additional basement below the existing building.

4.3. Two phases of soils investigation undertaken by STATS in 2008 and the additional soils investigation by GEA in July 2016 identify that the geology at the site consists of Made Ground, underlain by Bagshot Formation, underlain in turn by London Clay. The proposed basement is likely to be founded within the Bagshot Formation, which typically comprises medium dense to dense gravelly sand with safe bearing pressure of 150kN/m^2 for raft foundation and 200kN/m2 for spread foundation. Following the initial audit, additional information has been provided and it has included an estimation of loading and checking of the adequacy of the bearing stratum.

4.4. It is accepted that the site is at the highest point on the cusp between Golders Green Pond Chain Catchment and Hampstead Pond Chain Catchment. It is noted that the site is in Flood Risk Zone 1, where land is assessed as having less than a 1 in 1000 annual probability of river or sea flooding, and is not identified as a street that flooded in either 1975 or 2002. Thus, flooding is highly unlikely.

4.5. It is noted that the proposal will not alter the existing proportion of hard surfaces and paved areas and, hence, the quantity of local rainfall entering the existing sewer system.

4.6. The BIA states that although the site is located directly above a Secondary A aquifer, the proposed basement will have no impact as the groundwater level is 18m below the existing ground levels. However, the groundwater monitoring results in STATS Geotechnical Report, Section 4.2, show that water, possibly perched water, was present at 8.42m but not at deeper level of borehole BH1. Water was also absent in boreholes BH3 and BH5 at the time of the

monitoring visits by STATS in 2008. Following the initial audit, additional ground investigation and water monitoring has been undertaken by GEA. The additional investigation includes two new boreholes down to 12.45m below ground level and groundwater wasn't encountered during drilling. One of the new borehole was found dry at all monitoring visits, while the other boreholes had water, possibly perched water, at approximately +124.73 AOD, which is about 5m lower than the proposed basement level.

4.7. Following the initial audit, additional information has been provided by JNP Group and it has stated that the retaining walls will be constructed by traditional hit and miss reinforced concrete underpinning or contiguous piled walling. Acceptable details of the retaining walls have been provided, along with structural design calculations and descriptive methodology of basement construction. However, it is noted that the structural drawings still show the car park extension at lower ground level, below the front forecourt. The structural design and drawings should be updated to reflect the proposed plans as shown on the architectural drawings submitted in July 2016.

4.8. Following the initial audit, a ground movement assessment (GMA) undertaken by GEA was provided. Oasys Pdisp has been used to predict the movements as a result of excavation. Up to 14mm heave is predicted in the centre of the excavation reducing to maximum 6mm at the edge. It is noted that the GMA has included the car park extension at lower ground level. The GMA should be updated to reflect the proposed plans as shown on the architectural drawings submitted in July 2016.

4.9. The horizontal and vertical deflections as a result of underpinning and excavation have also been predicted using Oasys Pdisp with the movements then imported into to Oasys Xdisp which was used for the movements in the piled section of the basement. Ground movement curves for excavation in stiff clay have been used although the site is underlain by Bagshot sand and gravel.

4.10. Category 0 (Negligible) damage is predicted for Heath House itself and all the boundary walls considered with the exception of one to the south where Category 1 (Very Slight) damage is predicted.

4.11. Queries were raised on the method of analysis as it is not considered appropriate to use Pdisp to predict movements due to underpinning (both installation and excavation) and ground movement curves in stiff clay for the piled section when the site is underlain by Bagshot sand and gravel. It was suggested the methods of analysis be reconsidered to enable a more realistic prediction of the anticipated ground movements based on the ground conditions at the site. GEA have stated in response to the queries that the predicted movements are *'what is to be expected based on experience*'. However, this required justification by the use of appropriate modelling or empirical assessments.

4.12. Movement resulting from underpinning is almost entirely due to workmanship and whilst it may be possible to limit damage to within acceptable limits provided the works are properly controlled and the affected structures are in sound condition, stability of the neighbouring properties and infrastructure still needs to be demonstrated. On the basis of the approach used both in predicting movements due to underpinning and the piling, it is not possible to verify the conclusions made in the GMA.

4.13. The BIA Screening Stage identifies that trees are anticipated to be affected by the proposed development. The Scoping Stage refers to the Landscape Planning Strategy and Tree Protection Plan and states no further action is required. However, the Landscape Planning Strategy states that there are three Category “B” trees covered by a Tree Preservation Order and they are to be retained and protected during construction.

5.0 CONCLUSIONS

5.1. The BIA has been prepared by JNP Group Consulting Engineers and includes documents prepared by STATS Limited in 2008. Following the initial audit, additional ground investigations, ground movement assessment, and damage assessment were undertaken by Geotechnical & Environmental Associates (GEA) in July 2016. The authors of the submitted documents have been confirmed to possess suitable engineering qualifications that meet LBC requirements.

5.2. The development site involves a Grade 2 listed building.

5.3. The proposed scheme is an amendment to a consented scheme in 2008. The primary changes are the extent of the lower ground to form a larger car park and the change to the layout of the proposed basement below the existing building.

5.4. The ground investigation and subsequent water monitoring by STATS in 2008 indicates the groundwater level to be in excess of 18m below existing ground level. Following the initial audit, additional ground investigation and water monitoring have been undertaken by GEA. The additional information indicates that groundwater level is likely to be much lower than the proposed basement level. Perched water may be present at +124.73 AOD, which is about 5m lower than the proposed basement level.

5.5. It is accepted that there are no hydrogeological or hydrological concerns with respect to the development proposals.

5.6. It is accepted that the risk of surface water flooding is low.

5.7. Following the initial audit, additional information has been provided by JNP Group. The basement walls below the existing Heath House will be formed by reinforced concrete underpinning. The basement walls to the west will be formed by contiguous piles with waterproof concrete lining walls. Outline calculations for the slabs, foundations, and retaining walls have been provided. These are based on cautious estimates of engineering values and assumptions.

5.8. An outline construction sequence has been provided with indicative temporary works to support the. It is noted that detailed construction methodology will be developed by the contractors at later stages.

5.9. Following the initial audit, Ground Movement Assessment and Damage Assessment have been carried out to assess the effect of the proposed development on the existing Grade II listed building and the boundary walls. The predicted damage category for the existing building is generally Negligible (Burland Category 0). All of the boundary walls are predicted to also have

Negligible damage category, except one to the south, which possibly have Very Slight damage category (Burland Category 1).

5.10. There are queries on the approach used in the Ground Movement Assessment and it is possible to verify the conclusions drawn.

5.11. The BIA has provided an appropriate ground movement monitoring strategy to monitor the existing building and adjoining boundary walls during the construction stages.

5.12. The revised structural drawings and the ground movement assessment (GMA) have included the car park extension at lower ground level, which has been omitted on the revised architectural drawings submitted in July. The structural design and the GMA should be updated to reflect the proposed plans as shown on the architectural drawings.

Appendix 1: Residents' Consultation Comments

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Mayo	Redington Frognal Association		Effects of basement excavation on the Listed building.	See 4.7 – 4.12
Turner	Hampstead Hill Gardens		Underground excavation in unstable land	See 4.7 – 4.12
Harms		15 Dec 2015	Underground excavation in notoriously unstable Bagshot Sand and shifting gravel.	See 4.7 – 4.12
Hunger-Craig	Camden Town Hall, WC1 H9JE	11 Dec 2015	Effect of construction on protected trees.	See 4.13

Appendix 2: Audit Query Tracker

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Audit Query Tracker

Query No	Subject	Query	Status/Response	Date closed out
1	BIA	Confirmation that qualifications of authors/ reviewers comply with requirements of CPG 4	Closed	01.09.2016
2	Stability/hydrogeology	Confirmation of groundwater level and impact on hydrogeology	Closed	01.09.2016
3	Stability	Structural Engineering Design Strategy and Construction Methodology	Open	See 4.7
4	Stability	Ground Movement Analysis and Damage Assessment	Open	See 4.8-4.13
5	Stability	Detailed movement monitoring scheme for the existing Listed building	Closed	01.09.2016

Appendix 3: Supplementary Supporting Documents

None

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